A Study on Immunological Responses to Exposures Encountered in Corn Farming

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When compared to the general population, farmers have an increased risk of non-Hodgkin's lymphoma (NHL). It has been hypothesized that altered immune function may be an indicator of increased potential for the development of immunologically based diseases such as NHL. We launched a study to investigate changes in immune function in corn farmers in relation to farming activities and pesticide exposures.

We selected 30 corn farmers and 10 agricultural extension workers in Iowa, ages 40–60 years, who were nonsmoking males. Farmers and controls were visited at six times during the year coinciding with critical periods in the growing season (e.g. prior, during, and after planting; prior and after harvest; off-season). Blood and urine specimens were collected at each visit, and detailed information about farming, pesticide use, and recreational activities were recorded during the entire year. Exposure to selected pesticides (e.g. atrazine, 2,4-D, and organophosphates) is assessed through quantification of their respective urinary metabolites in combination with questionnaire information. Immune status is investigated by measurement of lymphocyte subsets and activation markers, circulating cytokines and immunoglobulins, and by performing lymphoproliferation assays to mitogen and recall antigens in vitro.

All scheduled farm visits were successfully completed, and 100% of blood/urine specimens were collected and processed. Farmers reported the use of 97 different product names containing 61 different active compounds. Atrazine, glyphosate, and 2,4-D were the most frequently used pesticides. On average, farmers were applying pesticides for 98 h (range 23–227) between planting and harvesting with most applications taking place between April and July. Baseline information on available cell counts and activation markers indicates an overall healthy population as values are generally within the normal range and most did not differ between farmers and controls, except for natural killer cells ($p = 0.04$) that were found to be lower in farmers than controls. CD-69 and CD-25 T-cell activation markers were generally lower in farmers than controls. No difference was found for HLA-DR, a class-II T-cell activation marker.

The detailed exposure information, the longitudinal design, and extensive battery of assays to quantify immune status will provide a valuable opportunity to study the possible relation between farming, pesticide exposure, and potential immune perturbations. Considerable variability exists in pesticide use between farmers providing good exposure contrast in the population. At baseline some differences in early T-cell activation markers were observed, however the numbers are small and further analyses are still needed.

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